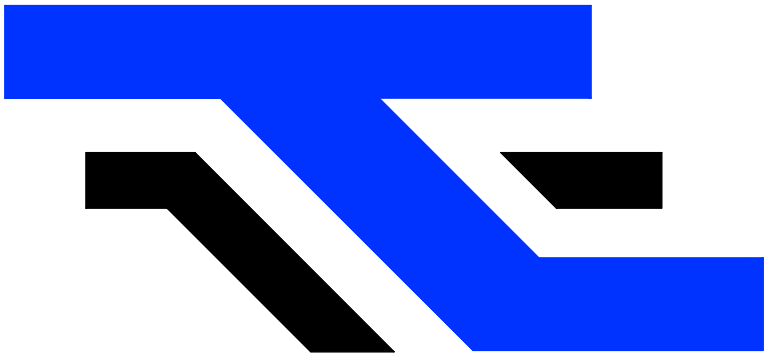

Chapter 8
Teaching Technology Education

MISSOURI TECHNOLOGY EDUCATION GUIDE
2002 v. 2.1

Teaching Technology Education

1. Introduction

As most educators know, the principal facilitator of student learning is the classroom teacher. If they are successful in establishing an atmosphere of mutual respect and if they genuinely care for their students' welfare much learning will take place. Part of this atmosphere comes from how classes are taught, some from the materials and methods used, some from the accommodation of individual differences, and some from the provision of quotable instruction for all.

2. Planning Instruction

Planning instruction for a Technology Education program should be no different from the processes used for any other classroom/ laboratory course. Theory and common sense indicate that a variety of methods must be used in order to provide the widest range of learning opportunities for students with diverse learning styles. By thoroughly planning for educational experiences, consideration can be given to students who are visual learners, auditory learners and those who prefer learning through kinesthetic (hands-on) activity.

Principles of Learning

The planning of instruction must reflect careful consideration of the principles of learning. Although many have outlined these principles, one of the most understandable sets was delineated by Dr. Blair of the University of Illinois. Figure 8-1 presents these principles and it should prove to be of considerable assistance to TE instructors as they plan their instruction.

Figure 8-1
Blair's Principles of Learning[1]

1. Without motivation there can be no learning at all.
2. Without a sufficient stage of readiness, learning is inefficient and may even be harmful.
3. We learn to do by doing.
4. We learn to do what we do (and not something else).
5. For effective learning, responses must be immediately reinforced.
6. Meaningful responses are better learned and retained longer than less meaningful ones.
7. For the greatest amount of transfer learning, responses should be learned in the way they are going to be used.
8. An individual's responses will vary according to how he/she perceives the stimulus (situation).
9. An individual's responses will vary according to the classroom atmosphere.
10. Every person always does the only thing he/she can possible do considering their physical inheritance, background of learning and the forces that are acting upon them.

Tischler's Thoughts on Learning

A delightful source on useful teacher hints that can effectively guide the instructor as he/she plans their teaching methods is found in Tischler's pamphlet entitled *Thoughts on Learning*... He has assembled a set of valuable insights but then he has moved beyond mere summary by highlighting their **implications** for teachers. Figure 8-2 presents a sample selection of these.

[1] Adapted from Dr. Glen Blair, University of Illinois-Urbana.

Figure 8-2
Tischler's Thoughts on Learning[2]

Principle: The whole does not necessarily equal the sum of the parts. Example: you can teach a student all about nails, screws, lumber, windows, doors and paints and he/she still cannot build a house (a system).
Application:
Any subject to be taught is like fitting together the pieces of a puzzle. Organize your materials so that the student first sees only the system without the details. Details often require specific skill development or prerequisites neither of which the beginner may have. Later relate each detail to its place in the system.

Principle: The teacher is like a person standing on a cliff watching a cliff watching a canoer navigate a turbulent twisting river. From the teacher's vantage pint, he/she sees the whole (the overall concept) of the problem. The student, like the canoer experiences one surprise after another. Each turn is a new challenge. Each moment is loaded with anxiety and surprise. Oh, for the student to have the vantage pint of the teacher.
Application:
Before starting a curriculum, a course, or a lesson, develop the concept theme. Arrange your activities so that the student is standing on the hill looking at the overall subject matter before starting into the details. Then, form the student's vantage point he/she should be better able to determine his/her future plan of action or reaction.

Principle: When one approaches learning as an opportunity to "discover something" rather than the task to "learn about something," the feeling of self-reward takes over, thus causing interest and in-depth investigation.
Application:
The teacher should organize his/her subject to excite the student toward the thrill of discovering some new thought or idea. The student will thus be motivated to learn. Discovery through learning causes a behavioral change. Repeating of fact may be dull and not contribute to learning. Discovery may lead to disappointments, but it also may lead t the thrill of greater discoveries.

Principle: Tell the student what and how you are going to teach him/her. Teach the student what you told him/her you were going to teach him/her. Tell the student what you taught him/her.
Application:
Before teaching subject matter, explain how you have organized you program and what methods of teaching you will be using. You cannot expect the student to learn, when he/she doesn't know how you expect to teach him/her. Then be sure to follow the methods you have outlined, and summarize by telling what you have taught.

[2] Tischler, Thoughts on Learning, n.d.

Principle: Learning is easier and more effective when the student uses two or more of his/her sensory transducers.

Application:

For any subject, present your material so that you require the student to use as many of his/her senses as possible. Hearing provides about 15% perception, seeing 60%. Don't stop with these. There is still 25% more reception to tune in on: touch, smell, taste and the emotions.

Principle: For education to be meaningful, it must do something for the student in the present. The future may be too far away to be meaningful.

Application:

Education must pay off now! The fact that it will be helpful later is nice to know, but if education doesn't pay off in the present – the same type of education may not apply for the future. Education must be meaningful—not a promise. If you teach Algebra I because it is a need for Algebra II then the program is doomed to fail, since it provides no compensation right away; only a promise for a future goal.

Principle: An explanation of subject matter, even today, is composed of too large a proportion of words and too small a proportion of understanding.

Application:

Come to class prepared. Know what and how you will present the subject. If you really know this, perhaps it will not take many words. Find better ways to present your subject, by minimizing on words, maximizing understanding.

Principle: Learning starts from an understanding of previous experiences upon which new ideas are built. During the transition ideas are built. During the transition process material things become less important, and meaningful verbal expression becomes more important.

Application:

The beginning student needs a variety of activities. The retention span appears short. Use several activities to present the same material. For Example: present the abstract; validate the information by experiment. Then apply the theory, method of relating the experiment, to an actual application. In the laboratory the student tests the teaching, book, film, etc. In the application the teacher should test the student.

Principle: Learning is not obtained through a single inoculation: Once you've had it, you won't need it again. Booster shots are needed to assure continued proper response by the learning system.

Application:

Don't expect the student to remember the facts just because you taught them once before. From time to time you must reinforce the information previously taught. Remember the bucket you are filling may have a slow leak. Some leaks may not be so slow.

Principle: Understanding human memory is quite complex. One thing is certain, unless a detail is placed into an organized structure, it is soon forgotten. The organized structure is a SYSTEM.

Application:

Decisions can be made based on a broad conceptual understanding providing the known facts are all part of a system of walking, talking, eating and sleeping are all detailed, systematic processes. Without knowing the details the child is able to learn. Teachers, on the other hand, often feel the student won't understand unless he/she is first given all the details.

Principle: The development of a CONCEPT depends upon the study of the relationship between seemingly unrelated facts. The concept grows broader as these relationships come closer together.

Application:

The learner may not see the relationship between seemingly unrelated facts. The teacher can show how these facts fit together so as to help the learner develop an overall understanding (a concept). The tighter the relationship is brought together the better the understanding of the concept.

A Sampling of Teaching Methods

Field trips

Utilize field trips for more than observation of technological processes. Use discussion and oral or written reports on the various occupations involved in the process observed. Bring back the experience with modern communications technology.

Guest Speakers

Have one or more speakers address the class about past or present processes and occupations and the training and skills required. Have them discuss the rapidity of technological change and highlight emerging technologies.

Student personnel system

When setting up the organizational chart, try to emulate industrial organization and procedure. Provide specific information on the occupations involved.

Interviews

Require students to interview people involved in various occupations. Have them make written or oral reports to the class. Provide guidelines for the format of interviews. Include questions about how one best prepares for such employment.

Bulletin board

The bulletin board can be an effective teaching method if used properly. Place items on the board that will stimulate interest and questions, something that will make them want to find out more, then provide students with a way to do so. Change your display often!

Class discussion

Class discussions can be interesting and involving for students – if they are carried out in a non-judgmental manner. Listen to what students have to say and try not to dominate the discussion. Set up situations causing students to associate and make applications of the information presented.

Role Playing

By means of simulated technological/ industrial activity, role playing affords students the opportunity to identify with typical life activities as they exist in various occupations and/or professions. Through role playing, students can experience some of the reality of work responsibilities. It is especially well suited for use with enterprise laboratory activities, mass production activities, research and experimentation and group project experiences.

Group project

The group project method involves the designing, planning and development of a product by a group of students. It differs from the mass production method in that only one (or a few) finished product(s) results from the activity of the group. Ideally, the project selected has numerous elements thus permitting the effective use of teams or

other sub-groups. The method has been used successfully at the junior high level for studying high volume production industries such as paper and paper products, oil, iron, glass and rubber. At the senior high level, the group project might take the form of designing and constructing a machine, vehicle prototype or other large, even interdisciplinary, projects.

Conceptual Learning

This approach is based on the notion that concepts have greater application to new situations than do specific facts. Current educational theory emphasizes the need to develop fundamental concepts and skills, which have functional value in a wide variety of applications. This learning generally is referred to as conceptual learning. For example, the concept of molding enables the student to relate general knowledge and skills to many specific types of industrial processes such as forging, foundry and casting and in several material realms e.g. metals ceramics and plastics. A study of general or fundamental principles insures that loss of specific details will not mean a total loss. The remaining understanding will permit reconstruction of details when necessary.

Enterprise

The enterprise approach involves a simulation where students assume career roles and solve problems in a manner similar to their counterparts in industry. The enterprise method often involves such activities as research and development, financing, mass production, servicing, communication, transportation, distribution and marketing. At elementary and junior high levels, the emphasis might be directed toward activities of simplified nature, since only limited time would be allotted for the activity. At the senior high level, activities may be more complex and greater emphasis is placed on tooling and higher technology.

Cooperative work study

Many students enrolled in TE programs can profit from on-the-job experiences designed to supplement in-school learning. Such experiences assist students in further development of skills and positive attitudes toward work and school. Often work experience helps students in assessing and establishing career goals and this enhances their potential for successful employment in the future. Other significant out-of-school techniques include industrial observation and community projects. All out-of-school industrial experiences require supervision and evaluation by qualified school personnel to ensure that the experience and environment are adequately serving the student's educational goals and that safety and other safeguards are provided.

Seminar

The seminar method emphasizes student interaction and contribution. It is used to identify individual problems and to provide for group assistance in finding solutions to these problems. The seminar provides a continuing opportunity for student peer evaluations as well as presentation of individual student progress. With the seminar method, the teacher(s) assume(s) the role of facilitator, observer, evaluator and advisor. In the seminar students become involved in challenging, questioning, assisting and discussing. The method has been used successfully in combination with the enterprise,

group, interdisciplinary research and experimentation and other more traditional instructional methodologies.

Individualized instruction

Individualized instruction provides for the varying abilities and interests of students. It involves development of self-instructional units or modules in a manner which enables students to be independent: (1) pre-assess their performance and knowledge of the objectives, (2) progress through specified learning activities at their own pace and (3) assess their own terminal performance and achievement of unit objectives. Missouri's TAMS capitalize on the benefits of this approach. A variety of hardware and software systems have been developed to facilitate management of the instructional approach. These include auto-tutorial systems, interactive video, programmed references, student contracts, learning activity packages, educational games, and computer-assisted instruction. All have great potential for helping students learn and consequently their use is strongly encouraged.

3. Selecting Instructional Methods

Technology Education is concerned with technology, industry, its practices, procedures and products. Within the classroom/laboratory, student experiences should be tailored to develop understandings, attitudes and skills pertaining to technology rather than to the production of a take-home product (the project). Although a finished product may well be produced by each student, or by a group of students, it is important to remember that the project is not the goal but rather it is the by-product of the process of learning about technology and industry.

Curriculum content is not the only important element in the teaching-learning process. Because of the differences in pupil learning styles and teacher proficiencies, varied instructional methods must be used and evaluated. Traditionally, many instructional methods have been used in technology education programs. Methods such as lecturing, demonstrating, designing, problem solving, and constructing individual projects have long been recognized as effective instructional approaches for presenting content. These are being supplemented by emerging instructional methodologies which provide increased potential for developing technological, industrial and career understandings, attitudes and skills.

When developing TAMS and lesson plans for a program, it is essential to decide which teaching methods will be most effective. The instructor has many options, when selecting the appropriate instructional method for each student, and for each type of class. **It is important that teachers use more than just those they learned while at college.**

The following is a list of methods for adding variety and interest to technology education programs. Combinations and permutations of this list are not only possible, but are desirable and should be encouraged. But methods alone will never be sufficient. The ultimate success of these as well as other techniques depends on the innovativeness, interest and skill the teacher exhibits in presenting the material.

Community resources
Conceptual learning
Research and experimentation
Contract
Cooperative Seminar
Demonstration
Enterprise
Exercise approach
Field trip
Inquiry
Lecture
Mass production
Problem solving
Production
Conference
Show and tell
Role playing
Student personnel system
Discovery
Team teaching
Group project
Case study
Written or oral reports
Work study
Individualized instruction
Guest speakers

Instructional methods must be selected to capitalize on the unique needs of students in specific locales. The technology Education teacher must be alert to the resources of the community being served. Not only must teachers be alert to resources, they must also be aware of opportunities for integrating these resources into the instructional program. All resources such as speakers, industrial visitations, web sites, videos, slides, TAMs learning packages and bibliographical resource materials must be evaluated on the basis of their merit to the instructional program. Figure 8-4 provides some useful guidelines for the selection of delivery systems.

Figure 8-4
Guidelines for the Selection of Teaching Methods

- The best procedure usually is to select the least elaborate and least costly strategy that will enable the learner to acquire the desired capability.
- All things being equal, well-illustrated, step-by-step verbal instructions with feedback to the student constitute the most practical, effective and efficient strategies for most types of learning.
- If an objective is accomplished in less time with one strategy than another, it is more efficient. If the retention or transfer of the information or skill learned is greater for one strategy than another, then it is more effective for reaching the objectives. When determining the approach to be followed, the best estimate of both efficiency and effectiveness will have to be followed.
- Try to select flexible strategies that can be adapted to student needs, problems and interests.
- Strategies that give students an opportunity to share in goal-setting, learning experiences and evaluation often produce better results.
- Students need an opportunity to work with strategies that provide opportunities to inquire, to analyze, to explore, to be active, to create and to initiate.
- The strategy selected should give the teacher an opportunity to observe student progress.

Individual preferences, ease for the instructor, and simple convenience are not strong reasons for instructional choices. TE instructors also need t compare their decisions to state and national guidelines. Figure 8-5 presents the MOITE standards, topic 7, the Instructional Strategies. Instructors are advised to review their own decisions against these recommendations keeping in mind that local differences and student needs may provide grounds for a departure from these standards.

Figure 8-5
MOTE Standards, Topic 7: Instructional Strategies

Technology education is designed to help students comprehend technological systems and gain the ability to apply what is learned to real-life situations. Instructional strategies must be carefully selected to allow the student to engage in activities that allow them to utilize technological concepts to solve problems. This standard's statements topic concern instructional strategies i.e., methods utilized to deliver instruction and promote student achievement of goals and objective. The technology teacher plans, implements, and evaluates these strategies

Fill in marks to indicate assessment: ∇ not met, O met, Δ exceeded

1.	Teachers plan an prepare written courses of study designed to develop student competencies consistent with program goals and course objectives……	∇	0	Δ
2.	Teachers plan and prepare current lesson plans based upon the course of study and student needs……	∇	0	Δ
3.	Teachers consider alternatives and select appropriate methods to assist students in meeting course objectives……..	∇	0	Δ
4.	Teachers develop and/or obtain appropriate, up-to-date instructional materials……	∇	0	Δ
5.	Teachers plan and provide for evaluating the effectiveness of their instruction…….	∇	0	Δ
6.	Teachers provide input to the Individualized Education Program (IEP) committee for handicapped students enrolled in Technology Education……..……..…	∇	0	Δ
7.	Both teacher-centered and student-centered instructional methods are utilized, as necessary……..…	∇	0	Δ
8.	Instructional methods promote the development of process skills such as reactive and critical thinking, decision-making and problem solving……	∇	0	Δ
9.	Instructional methods utilized are based upon individual student needs rather than upon the sex of the students…….....	∇	0	Δ
10.	Instructional methods promote the development of process skills such as creative and critical thinking, decision-making and problem solving…….....	∇	0	Δ
11.	Instructional methods utilized are based upon individual student needs rather than upon the sex of the students……..……..	∇	0	Δ
12.	Instructional methods enhances opportunities for multi-disciplinary learning……	∇	0	Δ
13.	Local program student club or TSA chapter activities are integrated into planned courses of study and are utilized in conducting classroom and laboratory activities……..…	∇	0	Δ
14.	Instructional strategies appropriate for serving students with special needs have been identifies and incorporated, as needed, into the TE program..……..	∇	0	Δ
15.	Students achievement is measured through a variety of testing techniques and other evaluation methods……..……..….	∇	0	Δ
16.	Each identified handicapped student enrolled in technology education is evaluated annually through procedures and criteria described in the Individualized Education Program (IEP)……	∇	0	Δ
17.	Student leadership skills are developed through a variety of curricular and extracurricular activities……..……	∇	0	Δ
18.	Student achievement is assessed to make systematic decisions regarding the effectiveness of instructional materials and teaching strategies…..……	∇	0	Δ
19.	Provisions are made for student input into the evaluation of instructional strategies…….	∇	0	Δ

4. Meeting Students Individual and Special Needs

All students have individual differences and special learning needs. Traditionally, however, discussions related to special needs have centered on students with disabilities, but students with other individual differences must also be considered. Provision must be made for: educationally disadvantaged, economically disadvantaged, limited English proficiency (LEP), gifted students and those with diverse cultural backgrounds. Additionally, students' preferred learning modes must be considered when planning instruction. Some students simply learn more, more efficiently, and more effectively when presented information in visual, auditory and kinesthetic means. Educational methods and procedures, instructional programs and materials, and school facilities must be modified for the purpose of individualizing programs and instruction to ensure that all students will develop to their fullest potential.

Federal legislation and teacher concern has provided the impetus to modify existing educational practices for learners with special needs. Such legislation is reflected in Public Law 94-142, the Education for All Handicapped Children Act of 1975 and its subsequent amendments, the Vocational Educational Amendments of 1976, sections 503 and 504 of the Rehabilitation Act of 1973, and more recently, the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 (P.L. 101392) and Public Laws 98-199, 94-198, and 101-476. The latter, the Americans with Disabilities Act of 1990 extends protection to adults. All of these laws emphasize the need to identify and infuse educational strategies designed to provide viable educational programs for special needs students. Furthermore, the legislation requires public education to provide instructional programs which will be the least restrictive educational alternative for students with disabilities.

Identifying Special Needs Learners

Technology education professionals typically need not be concerned with detailed identification procedures for special needs learners, because they are the responsibility of other members of the education team. However, TE professionals should become familiar with some general characteristics of learners who are identified as "special needs" in order to better plan appropriate educational learning experiences and to contribute to the identification process when needed.

It should be recognized that the term "special needs" is an inclusive term which describes students with characteristics which may impede their ability to develop their maximum potential in unmodified programs. A broad understanding of the unique learning characteristics of students with disabilities, disadvantaged, limited English proficiency, or gifted/ talented will be helpful to TE professionals in modifying programs to accommodate students with special needs. The following material lists and describes characteristics pertaining to special learning needs.

Learner Characteristics

Disadvantaged

Disadvantaged students have academic or economic disadvantages which impair their ability to function in regularly structured school programs. These students typically may be members of families with low incomes, low or underachievers, from culturally restricted backgrounds or with limited English proficiency (e.g. unfamiliar with American customs or the English language). Generally disadvantaged students are of normal or above intelligence but they fail to achieve in the regular school.

Academically disadvantaged students often display language difficulties, reading or writing problems, severe computational difficulties, or other general learning problems. These students may be frequently absent from school, have a short attention span and display low motivation when in class. They are often self-conscious, easily discouraged, have low self-esteem and express feelings of isolation.

Economically disadvantaged students typically are members of families whose incomes are below the national poverty level, have parents who are unemployed or are recipients of public assistance. Generally, these students exhibit many of the same behaviors as academically disadvantaged students.

Limited English Proficiency (LEP)

Limited English Proficiency means individuals who were not born in the United States or whose native language is other than English; who come from environments where a language other than English is dominant; who are American Indian and Alaskan native students and who come from environments where a language other than English has had a significant impact on their level of English language proficiency; and who by reasons thereof, have sufficient difficulty speaking, reading, writing or understanding the English language to deny such individuals the opportunity to learn successfully in classrooms where the language of instruction is English or to participate fully in our society.

Gifted and Talented

Gifted and talented students are those who, by virtue of outstanding abilities are capable of exceptionally high performance academically, physically, or creatively. However, these students will not live up to their full potential unless a challenging instructional environment is provided. The gifted also have unique needs and, as a result, they require enriched and challenging activities guided by a caring and stimulating teacher. In fact, unless they are challenged, these students' talent and creativity may turn toward disruptive behavior. Teachers should not assume that gifted children will be able to take care of themselves because of their superior intelligence.

Students with disabilities

Students with disabilities are learners who have specific or general disabling conditions that may interfere with their functioning in a regular school environment. These disabilities may be sensory, physical, emotional, or any combination of the three. There are several terms used to classify students with disabilities. Among these are the mentally handicapped, hearing impaired, speech impaired, visually impaired, seriously

emotionally disturbed, orthopedic impaired, other health impaired, deaf-blind, multi-disabled and learning disabled. Because of these impairments, students with disabilities may need special education and related services.

TE professionals will most often be providing educational experiences for those students who fit the category of "high-incidence" disabilities (i.e., those who comprise approximately 80% of the total population of students with disabilities). Among these students are students with learning disabilities, mild retardation, speech impairments, and mild- to moderate-hearing or visually impairments. These students have been able to achieve success in the regular school environment when provided with supportive services and modifications in educational curriculum and teaching strategies.

Occasionally "low incidence" children with disabilities may also be placed in regular TE programs. However, most will be placed in self-contained situations such as community-based instruction, supported employment, and specially designed vocational programs where their needs are more appropriately met. Among the students who fall into this category are those with severe and profound retardation and severe emotional disturbance. Individuals with profound deafness or blindness and orthopedic disabilities also fall into the low incidence category. However, because of their general learning potential some have been able to function successfully in regular access/barrier-free school programs.

The placement of low incidence learners in a least restrictive environment must be determined through an extensive evaluation conducted by qualified specialists. Generally these special needs students will require support services in addition to an access/barrier-free building. Examples of such support include: interpreters, educational tutors/ aides and adaptive production jigs or fixtures.

The following provide a brief description of various disabilities. While not a totally inclusive listing, these characterizations will facilitate a better understanding for TE professionals of the general, physical, intellectual and social characteristics of students with disabilities.

- Individuals with "mild-moderate" mental retardation are those students who are capable of academic, social and vocational training, but who require specialized instruction to realize maximum skill development and meaningful integration into adult society.
- Individuals with "severe" mental retardation are those students who have potential for training in self-care, social adjustment, and vocationally-related areas rather than academic ones. During adulthood they may function effectively at home and/or in specialized situations such as supported employment and supervised living environments.
- Individuals with "profound" mental retardation are those students who are retarded to the extent that they are capable of very little self-care and often must have constant attention to survive.
- Students with learning disabilities have normal or above average intelligence but exhibit a specific learning disorder in one or more basic processes involved in understanding or using spoken or written language. Their learning problems are not due to visual, hearing, motor or environmental difficulties. Typical disorders which

may be the cause of a learning disability are perceptual dysfunctions, brain injury, minimal brain dysfunction, dyslexia and developmental aphasia.

- Students with severe emotional disturbance or severe behavioral disorders exhibit undesirable behaviors or feelings over a long period of time that adversely affects educational performance. Students in this category have an inability to learn which cannot be explained by intellectual, social or health factors. School-related characteristics may include poor interpersonal relationships with peers and teachers; a general pervasive mood of unhappiness or depression; periods of self-stimulation or withdrawal; and a tendency to develop physical symptoms or fears associated with personal or school problems. The term includes schizophrenic individuals, most of whom may profit substantially from instruction as determined through comprehensive and specialized evaluation.
- Students with visual impairments are handicapped in a normal educational program by their difficulty or inability to see. Under this heading, students are classified as partially sighted, legally blind or profoundly blind. However, many have demonstrated the ability to develop proficiency in using TE equipment with some modification of the learning environment.
- Students with partial sight or legal blindness are those who can learn to read print, but whose vision is limited (even with corrective devices), and who need instructional modifications in order to succeed in a regular educational program. Partially sighted persons have a vision of 20/70 to 20/200 after correction with lenses. Legally blind persons have less than 20/200 vision with glasses.
- Individuals with profound blindness have the most severe visual impairment. They cannot tell light from darkness and as a result, cannot see print. Often they can benefit from instruction in braille. These students must depend totally on their other senses to function satisfactorily in an educational program.
- Students with orthopedic disabilities are normally limited in mobility, sitting and/or the use of tools and equipment because of muscular, skeletal or neuromuscular impairment. Included in the related causes of orthopedic handicaps are cerebral palsy, spina bifida, curvature of the spine, muscular dystrophy, hemophilia or other defects in legs, arms, neck or hips. Orthopedically handicapped students are generally average or above average in intelligence and can function in a regular school environment which has been adapted and made barrier / access free.
- Students with hearing impairments have a loss of hearing which affects their performance in a regular educational setting. Their sense of hearing is limited in many ways. For example, if students cannot hear the ordinary sounds of activity around them, then they are considered deaf. However, when students can hear, but only hear part of what is said, then they are considered hard-of-hearing. Hearing losses may be mild, moderate, severe or profound.
- Individuals who are hard of hearing have some ability to hear and understand the spoken word. Although some words may be audible, the pitch and frequency of these sounds may make it difficult for these individuals to ascertain their meaning. Sounds are not necessarily just softer to these individuals but may also be garbled and distorted. Some hard-of-hearing students may require the use of hearing aids and/ or rely on lip reading. Likewise, deaf individuals must always require the use of an interpreter and/ or lip reading.
- Students with speech impairments normally have speech patterns which are noticeably different from the norm. There are many forms of speech impairment,

ranging from complete inability to speak to minor articulatory deficits. Furthermore, there are many causes for speech difficulties, ranging from delayed speech and hearing impairments to cerebral palsy and cleft palate.

- Students with other health-impairment are so categorized because they demonstrate limited strength, vitality and alertness. The conditions of these students are caused by chronic health problems such as heart conditions, tuberculosis, rheumatic fever, nephritis, hepatitis, asthma, epilepsy, leukemia or diabetes.
- Students with multiple disabilities exhibit combinations of two or more of the previously mentioned disabilities. For example, a student may be deaf and blind or orthopedically disabled and mildly retarded. As a result, special accommodations are necessary to facilitate their educational development.

Accommodating Special Needs Students in the TE Program

Educational methods and procedures, instructional programs and materials and school facilities must be modified for the purpose of tailoring instruction to serve special needs students in TE programs. The teacher cannot accomplish this task alone. Other professionals from such areas as special education, rehabilitation, school psychology, guidance and the community in general can help. Through cooperative efforts TE programs can effectively incorporate the fundamental elements for success and therefore be as appropriate for special needs learners as they are for other students.

The teacher remains the central factor governing the special needs student's potential for success in TE. The teacher's attitude, personality and self-concept will help govern his/her performance. Teaching students from special needs populations is very much like working with non-special needs students. Each needs empathy, guidance/ direction, understanding and an appropriate and challenging learning environment carefully managed by a knowledgeable teacher. There are however, some subtle, as well as obvious, characteristics of certain learners that require a change of teaching style. For example, teachers who tend to "kid" or "tease" their students may find that students with poor self-image or low self-esteem may interpret this as "ridicule," "cruel," and "inappropriate punishment". Likewise, special needs students want "empathy" – understanding of their limitations and the desire to help remediate them (and also build upon strengths) – rather than "sympathy." Teachers must continue to be firm but fair, consistent and yet flexible, and concerned and caring enough to challenge special needs students to achieve new goals and experiences.

5. Providing for Equity

When discussing equity it is important to remember that the term encompasses more than just gender equity. It means being fair and impartial to people regardless of their sex, race, age, religion, or sexual orientation. Most materials that have been published recently have been revised to be unbiased and fair. Additionally, many references to aid the TE teacher in evaluating materials and practices on the basis of gender bias have been developed. Furthermore, most of the materials can be adapted to other equity targets if their terms related to gender are replaced with others related to race, religion, age, or sexual orientation.

Similarly, recruitment and program admission policies and procedures must be evaluated in order to eliminate any unnecessarily restrictive statements. Poorly phrased or overly restrictive policies could bias class participation in unintended ways. Course prerequisites, if any, must be examined in the same way to determine if they are unnecessarily restrictive or are inadvertently prejudiced.

Change is a slow process and traditions are not relinquished easily. Technology Education teachers must examine their own beliefs and assess their appropriateness. If they are dedicated to quality education for all students, TE teachers must remove those barriers that prohibit equity for all potential students. Though technology education has been an integral part of the school curriculum for more than three-quarters of a century, there are students, parents and school personnel who may not be aware of this fascinating and important area of the curriculum and its potential for non-traditional students.

Efforts to bring about a better understanding of TE will help everyone appreciate its benefits for all students. Commitment for reaching all students involves some concrete action such as examining attitudes and behaviors, carefully choosing instructional materials and making conscious efforts to help people outside the classroom become aware of the accomplishments made by Technology Education. Figure 8-6 shows some of the strategies that will help in working towards increased equity.

Figure 8-6
Equity Strategies for Classroom Teachers

1. Be direct with students about bias. Point out racist or sexist bias in books or materials. Help them learn to identify sources of bias and important omissions in the materials.
2. Develop classroom activities around identifying bias found in television, textbooks, movies, library books or magazines.
3. Incorporate the development of critical reading skills as an instructional objective for all your teaching, not just when special efforts are being made to identify bias in materials.
4. Identify or develop supplementary materials which can help "correct" some of the bias of available materials.
5. Assign student papers, themes, term papers or other activities on topics or persons not usually covered in textbooks or materials.
6. Invite local resource persons into your classroom to provide additional information and work with students on special projects and activities.
7. Ask students to rewrite materials or write their own materials on subjects omitted from the textbook or write the material from another person's point of view.
8. Use bulletin boards, posters, pictures, magazines and other materials to expose students to information commonly excluded from traditional materials.
9. Develop a classroom collection of non-racist, non-sexist reading materials for students. Identify books that students may be encouraged to seek out in their personal reading.
10. Be proactive in recruitment of nontraditional students and organize informational activities designed to attract nontraditional students.
11. Create an technology education day where students in 6th or 7th grade can have hands-on experiences with technology.

12. Develop a video or web-based presentation targeted on non-traditional populations to encourage their participation in TE.

6. Evaluating Student Performance

Technology Education instructors are routinely expected to assess and document student progress towards their (and the program's) competency goals. Clearly student evaluation is an integral part of teaching and with the implementation of instructional management systems it becomes even more important. Instructors should be careful not to allow themselves to consider evaluation as an intrusion, as something that takes away from instruction/learning time. Indeed, when properly handled, student evaluation will maximize the effectiveness of their instruction. To implement a systematic and effective evaluation scheme instructors should note that:

- Evaluation involves assessing each student's progress towards documented course and individual goals and objectives (such as the mastery of certain competencies).
- Feedback should be provided on a timely basis and in a constructive manner so as to encourage desired action.
- Self-evaluation by the student is an essential part of the overall evaluation.
- Each domain of behavior should be assessed by the evaluation system. Avoid one-dimensional evaluation (e.g., only knowledge or only psychomotor skills).
- There is a difference between evaluation and grading. The former ascertains the student's level of performance—the latter applies judgments to these assessments and links them to the system's grading scale.
- At the middle/junior high levels, considering the developmental stage of the students, those who make an effort but fall short should not be failed merely because a lack of knowledge, skills, or attitudes. At the same time, students should receive average or above average grades only for documented accomplishment.

Purposes for Student Evaluation

Two major purposes guide teacher evaluation of student performance. They are typically called formative and summative evaluation:

- Formative evaluation is intended to have a shaping, guiding or other similar influence on students. It is administered before and/ or during the learning process and as such it serves to give students feedback as to how they are doing. It is usually considered to be less threatening than other forms of evaluation. Often it is self-administered by the student and may not even need to be revealed to the instructor--depending on the maturity level of the student.
- Summative evaluation occurs at the end of some learning episode. This could be after a lesson, a major unit, a semester or a course. The purpose of this type of evaluation is to document how much and/or how will a student has mastered the target competencies at that given point in time.

Pre-testing

Often instructors will want to pre-test their students prior to the beginning of a course or major unit. This is a highly recommended practice because it can tell them whether students:

- Have the prerequisite competencies necessary for success in the unit or course that is about to begin.
- Have mastered some or all of the competencies the unit or course is designed to develop.

The first readout can help the instructor identify and secure remedial help for deficient students. This can be used to bring weak students up to speed rather than slowing the entire class to accommodate their weakest member. The second readout would alert the instructor to allow advanced students to move at their own pace and reduce their likelihood of getting bored, disillusioned and/ or disruptive.

Evaluation Techniques

Just as in teaching, the richer the variety of methods used for evaluation, the richer the learning experience will be for the students. Effective TE instructors will employ a wide range of such techniques in addition to the standard observation, oral questioning and informal evaluation. Some of the more formal approaches include:

Module-based Testing

In programs using TAMs and other modules, instructors need to develop individualized evaluation systems that can be administered with a minimum of demand on teacher time for administration and grading. Typically this results in the use of combination of student self-assessment using product or process checklists, computer – based/ scored testing, module progress/ summary forms, or peer assessment. Often additional combinations of the following evaluation methods are employed.

Progress Charts

These serve as a visible reminder to all students of their progress. If posted openly, it also shows how they compare to their classmates-a situation that has to be carefully monitored because of privacy issues. Progress charts can easily be used to track mastery of competencies in each domain although they tend to be used more frequently with skill or job accomplishment.

Self- or Progress Checks

Especially when assigning more complicated and lengthy activities, it is desirable to encourage students to assess their own progress along the way. This is a lot better than having students find themselves short of the goal at the end of a long work period. Typically such progress checks are checklists of critical events or applicable criteria stated with enough detail and clarity that the student can assess his/her accomplishment of each step.

Rating Scales

Most often used to evaluate a finished project, activity or attitude, these scales can be completed by either the student, his/her peers or by the instructor. Typically such a scale evaluates the work, according to established standards on a scale of 1 -5. A sample is shown in Figure VI-8. Because of the standardizing effect such scales have, they help increase the instructor's objectivity across pupils and students. Additionally, if given to students in advance as is suggested, such scales help them learn and clarify what is expected of them. This is particularly important for affective performance measures. Such scales can also identify the weight placed on such criteria as:

- Accuracy and precision
- Finish
- Craftsmanship
- General design
- Degree of complexity / difficulty
- Time used
- Work habits
- Originality
- And many others.

Achievement Tests

Sometimes these are considered appropriate only for the cognitive domain (i.e., what students know) but this is a mistake. Properly constructed performance tests are also excellent for validating mastery of psychomotor competencies.

Instructors should be careful to evaluate only against the clearly stated goals/objectives of a course, major unit or lesson. Such tests need to be developed to measure the appropriate level of performance in each domain. The most systematic manner to insure this is to use a table of specifications that indicates how many questions, and which levels, will be used to assess each objective.

Good tests must be valid and reliable. Validity is simply that a test measures what it is supposed to measure and not something else. Reliability is the characteristic that insures the results are the same each time people with the same capability are evaluated. Also, good tests must necessarily discriminate between students who have mastered the desired competencies and those who have not. Effective tests are moderately difficult, they are systematically representative of the objectives and content, they are clearly objective in their assessment and they are reasonable in terms of their length (time). To be assured of quality, it is recommended that TE instructors systematically establish the reliability and validity of their tests.

Instructors are advised to keep an ongoing bank of test questions and that each question be coded to an objective and to where the answer may be found, e.g., textbook page. Another desirable practice is to submit major unit and course tests to an item analysis program. This gives the instructor an excellent insight into the quality of his/her test and thereby encourages refinement for the next time. With the increasing number of test-scoring machines in the schools, such programs are more easily available.

Oral Test/ Questioning

Typically this kind of evaluation is one of the mainstays of TE. It works well to check on reading and other homework assignments and as a preliminary review for major written tests. To increase objectivity and systematic courage, it is recommended that instructors develop the questions and an answer key in advance of the administration of an oral test. Similarly a form for recording responses helps utilization of the oral questionings results.

Improving Written Tests

Written tests can take many forms: true/false, multiple choice, matching, short answer and essay are among the most frequently used. Written tests should contain a sufficiently large number of the significant items selected from the content included in the course. They should include a variety of types of items each phrased in suitable vocabulary with an appropriate range of difficulty. Tests should be attractive and easy to read. Drawings and sketches may be used effectively in test items and they may help to make the test interesting to the student. Test directions should be brief, but definite.

Items used on written tests generally fall into three categories: essay, recall and recognition. Multiple choice, true-false and matching items are of the recognition type while listing and completion items are of the recall type.

- The essay type of item requires that a student understand the subject matter thoroughly and express this knowledge in written form. When essay items are used, care should be taken that the topic is of major importance to the course. Since a considerable amount of time is required to write an essay answer, this type of examination usually involves a limited sampling of the total area of instruction. Subjective judgment is required in the scoring of essay type answers. However, a careful analysis of the material encompassed in the item and the preparation of a rating scale may help to make scoring of these items more objective. The instructor should be alert to the writing ability of the student when he/she uses essay tests.
- Recall items require the student to complete a statement, supply an answer to a question, or list certain items. The answer may involve simple facts or concepts that are of importance to the work, or may require the solution of a problem which applies these concepts. Scoring of items of this type requires reading the answers and applying judgment in cases where several different words could supply the same meaning. This task is easier if spaces for the answers are placed at the left of the page rather than in the text of the items. If separate answer sheets are used, they should be ruled or printed to provide uniform spacing for the answers.
- Recognition type test items require that the student select a response from a number of given possibilities. Properly constructed recognition type items provide a desirable means of objective testing, since the respondent must choose one correct or best answer. Recognition type items lend themselves well to the use of printed answer sheets, perforated scoring masks and computer scoring (added).

Students may guess right answers for recognition items; however, the effects of guessing are decreased as the number of items in a given test is increased. A true or false test should contain at least fifty items to reduce the effects of guessing. The guessing

factor in multiple choice or matching items is less important if four or five plausible choices are provided."

Grading

After evaluation mechanisms are employed TE instructors face the challenge of converting these results into a grade. This is typically a difficult task because it involves a considerable amount of professional judgment. Here the instructor must be careful to be:

- Fair to students regardless of their personal feelings.
- Consistent from class to class-
- Systematic in assessing all desired dimensions of performance.
- Accurate to avoid mistakes.
- Free from bias of any kind

One of the best ways to meet such high criteria is to carefully document the evaluation criteria and grading system. When looking at a system on paper, the errors and weak assumptions just seem to "jump out" at you.

7. The Career and Technical Student Organization (CTSO)[1]

The concept of an organization designed to support students learning a vocation had its roots in the activities of such institutions as trade guilds and apprenticeship societies common in the 18th and 19th centuries. In more contemporary history, the development of career and technical education (formerly vocational education) and the career and technical student youth organization (formerly vocational student organization) can be chronicled through a number of relevant Federal laws. The information below outlines the federal role in career and technical education from current law back to its inception in 1918.

Carl D. Perkins Vocational and Technical Education Act of 1998

The 1998 Perkins Act, an updated version of 1984 and 1990 Perkins laws, is the vehicle for providing federal support for career and technical education. Targeting primarily programs for high school students and postsecondary students attending community and technical colleges, the Perkins Act lists four basic purposes: (1) to build on the efforts of states and localities to develop challenging academic standards; (2) to develop services that integrate academic and technical instruction and that link secondary and postsecondary career and technical education; (3) to increase state and local flexibility in providing career and technical education programs, including tech prep; and (4) to disseminate national research and provide professional development and technical assistance to improve career and technical education. The Perkins Act specifically includes career and technical student organization activities as allowable at the state and local level. (from *The Official Guide to the Perkins Act of 1998* by the Association for Career and Technical Education)

[1] Career and Technical Student Organizations: A Reference Guide, Second Edition 1999, US DOE

Vocational Educational Act of 1963

This act and its subsequent amendments of 1968 and 1976 specified that vocational student organizations were an essential part of vocational instruction; vocational education, therefore, became a legitimate recipient of federal and state grant funds for the purpose of providing leadership and support to vocational student organizations and applicable and appropriate activities. (from *The National Association of the Vocational Industrial Clubs of America: Development of a National Organization, 1965-1990* by Karen Hale) 9 8

Public Law B1-740 (1950)

This law, referred to as Public Law 740, federally chartered a vocational student organization, thereby establishing the relationship of a vocational student organization to industrial arts education. It also officially tied the U.S. Office of Education to vocational student organizations by allowing employees of the U.S. Office of Education to be hired for the purpose of working with student organizations. Although this law chartered only one student organization (the vocational agriculture student organization), it established the pattern of treating existing and future vocational student youth organizations as integral parts of vocational education. (*Ibid*.)

"George Acts"

These acts (1929, 1934, 1936, and 1946) were a series of laws that supplemented and continued the appropriations for vocational education started by the Smith-Hughes Act. Of the four acts, the most important to youth organizations was the George-Barden Act of 1946, also known as the Vocational Education Act of 1946. This act was the first to mention a vocational student organization by name, and it specifically stated that funds could be used for vocational agriculture teacher activities that were related to the vocational agriculture student organization. (*Ibid*.)

Smith-Hughes Act (1918)

This act, often referred to as the "Granddaddy Act" of vocational education, in effect provided the foundation for vocational student organizations. Although the act did not specifically mention student organizations, it provided funds for vocational agriculture teachers whose duties included advising and supervising a vocational student organization. (*Ibid*.)

Today, the career and technical student organization (CTSO) is regarded as an integral part of career and technical education. There are ten CTSOs recognized by the U.S. Department of Education (see Section 3). These organizations provide a unique program of career and leadership development, motivation and recognition for secondary, post-secondary, and adult and collegiate students enrolled, or previously enrolled, in career and technical education programs. Educators have found that the CTSO is a powerful instructional tool that works best when it is integrated into the career and technical education curriculum by a trained professional. The dedicated instructor provides organized curriculum-oriented activities that help students gain career, leadership, and personal skills that maximize employability and the ability to become productive citizens in the workforce, home and community.

The ten CTSOs recognized by the U.S. Department of Education are:

- Business Professionals of America
- Distributive Education Clubs of America (DECA)
- Future Business Leaders of America (FBLA)—Phi Beta Lambda (PBL)
- Family, Career and Community Leaders of America (FCCLA)
- Health Occupations Students of America (HOSA)
- National FFA Organization (FFA)
- National Young Farmer Educational Association (NYFEA)
- National Postsecondary Agricultural Student (PAS) Organization
- SkillsUSA–VICA (formerly Vocational Industrial Clubs of America)
- Technology Student Association (TSA)

PLEASE REFER TO CHAPTER 7 FOR A COMPLETE OVERVIEW OF THE TECHNOLOGY STUDENT ASSOCIATION (TSA).

8. Developing Employability Skills

Employability skills refer to competencies possessed by individuals which allow them to get and keep a job. Occupational skills associated with specific jobs are not employability skills. Rather, what is being referred to are things such as dependability, punctuality and general work attitudes. Typically employability skills involve competencies in three primary areas: personal characteristics, job seeking techniques and entrepreneurship awareness.

Why should employability skills be of concern to TE teachers? There are several reasons. Many TE students will go on for further training in vocational education programs and the skills learned in TE will make it a great deal easier for them to succeed. Many students find work after high school and will be in need of these skills in order to keep their job. Some students work part time while going to school and employability skills make it possible. Still other students drop out of formal education and attempt to find work on a full time basis. Without these skills they are likely to be doomed to failure.

There are three major components of employability skills education. Skills needed to get a job, and skills necessary to keep a job are the first two. Both are equally important and neither should be overlooked. It stands to reason that in order to keep a job you must first get one. Conversely it does little good to get a job if you can't perform well enough to keep it. The third component, entrepreneurship awareness, represents job creation for oneself, rather than working for someone else.

The first order of business for anyone looking for work should be the acquisition of job seeking skills. Sample questions to ask when planning employability skills instruction are:

- How do you apply for a job over the phone?
- How do you answer a newspaper advertisement of a job?
- How do you interview for a job?
- What type of clothing should be worn to an interview?
- What information should be included in a resume?

- Are there any techniques that will make interviews easier?
- How is a job application form completed?
- Who and what are personal references?
- What should be done when offered more than one job?
- What criteria should be used to evaluate job offers?

Other than specific occupational skills, several personal qualities have been identified that employers expect and demand of employees. Employability skills are learned and can be taught in a systematic, logical manner. Some of these competencies are:

- Punctuality
- Dependability
- Reliability
- Being cooperative
- Showing initiative
- Perseverance
- Demonstrating respect for others
- Willingness to learn
- Personal hygiene
- Ability and willingness to follow directions
- Ability to get along with co-workers
- Ability to be self directive and complete tasks unassisted
- Ability to communicate with others
- Ability to accept, and profit from, criticism
- Technological capabilities commensurate with the job

Bibliography

_____.(N.D.). *Creative ways to supplement biased materials: An instructional unit in sex equity.* Jefferson City, MO: Special Vocational Services, Missouri Dept. of Elementary & Secondary Education.

Boben, D. K. (1985). *Guidelines for equity issues in technology education.* Reston, V A: ITEA.

Buffer, J. J. Jr., & Scott, M. L. (1985). *Special needs guide for technology education.* Reston, V A: ITEA.

Clendenning, L. R., & Dickey, 0. W. (1983). *Technology, free enterprise, and careers through industrial arts.* Preliminary Draft. Mount Berry , GA: Berry College & Georgia State Education Dept.

Miller, W. R. (1990) *Instructors and their jobs.* Homewood, IL: American Technical Publishers.

Tischler, M. (N .D.). *Thoughts on learning: Concepts for planners, supervisors, teachers, writers, salesmen.* Baltimore MD: Science Instruments Co. (6122 Reisterstown Road, Baltimore, MD 21215-3487).